

U.S.S.N. 10/626,998

Remarks

Thorough examination by the Examiner is noted and appreciated.

Applicants appreciatively acknowledge the indication of allowable subject matter in claims 29 and claims 32-34.

Claim 26 has been amended to incorporate the limitations from claim 32. New independent claim 65 has incorporated the limitations from claim 29. New claims 52-64 find their support in the original claims and are readable on the elected species originally presented in claim 26.

Applicants have added new independent claims 85 to define over the prior art.

No new matter has been added.

For example support for the amendments is found in the original claims as well as paragraph 0038 for new claims 60 and 80, for example in Figure 4 and in the Specification:

Paragraph 0038:

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"Typically, the blanket barrier layer 30 is formed to a thickness of from about 50 to about 500 angstroms. The atomic layer deposition method employs stepwise deposition of the above tantalum source material with stepwise evacuation and optionally stepwise nitrogen treatment to provide a tantalum nitride layer. The blank barrier layer formed by atomic layer deposition method would have different thickness on sidewall and on bottom of the dual damascene aperture due to surface conditions on sidewall and bottom are different. The surface condition on sidewall is a dielectric surface rather than a conductor surface on bottom. The deposition characteristic of atomic layer deposition is surface-dependent process in which the behavior of deposition would depend on the surface condition. In one embodiment, the thickness of barrier layer on sidewall is large than on bottom. Preferably, the sidewall barrier formed by atomic layer deposition is less than about 100 angstroms. The bottom barrier layer formed by atomic layer deposition is less than about 50 angstroms."

Claim Rejections under 35 USC 102

1. Claims 26-28, 30, and 31 stand rejected under 35 USC Section 102(e) as being anticipated by Pan et al. (US 6,656,832).

Pan et al. disclose a method for forming a dual damascene or damascene where an exposed conductor at the bottom of the opening is treated with at least one of an argon plasma with a radio frequency source power less than 300 Watts and a hydrogen

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containing plasma with a radio frequency source power of greater than 400 Watts (see Abstract). Pan et al. teach that preferably, the opening and exposed conductor are treated with a hydrogen plasma followed by an argon containing plasma where both the source and bias of the Argon containing plasma is less than 300 Watts and where the source power of the hydrogen containing plasma is greater than 400 Watts and the bias power is greater than 100 Watts (i.e., low argon plasma source and bias power compared to comparatively high hydrogen source and bias power (see col 6, lines 14-31; lines 54-67)).

Thus, Pan et al. do not disclose the following elements of Applicants disclosed and claimed invention including those elements in bold **type as shown in new claim 85**:

"providing a substrate having formed thereover a copper containing conductor layer;

forming a dielectric on the copper containing conductor layer;

forming an opening extending into the dielectric layer and

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over the copper containing conductor layer;

treating the copper containing conductor layer with a hydrogen containing plasma to form a hydrogen containing plasma treated copper containing conductor layer; and

treating the hydrogen containing plasma treated copper containing conductor layer with an argon plasma to form a fully treated copper containing conductor layer;

wherein the hydrogen containing plasma and the argon plasma are provided with a radio frequency source power from about 600 to about 800 watts and a bias power from about 10 to about 100 watts."

Thus, Pan et al. does not anticipate Applicants disclosed and claimed plasma treatment conditions, but rather teaches away therefrom.

Conclusion

Applicants appreciatively acknowledge the indication of allowable subject matter in claims 29 and claims 32-34.

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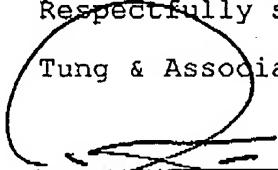
The claims have been amended to recite indicated allowable subject matter and to define over the cited prior art.

Based on the foregoing, Applicants respectfully submit that the Claims are now in condition for allowance. Such favorable action by the Examiner at an early date is respectfully solicited.

In the event that the present invention as claimed is not in a condition for allowance for any other reasons, the Examiner is respectfully invited to call the Applicants' representative at his Bloomfield Hills, Michigan office at (248) 540-4040 such that necessary action may be taken to place the application in a condition for allowance.

Respectfully submitted,

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